APPENDIX D
Documentation and Reporting for Comprehensive Evaluation of Project Datums

D-1. Purpose

This Appendix provides guidance on documenting and reporting project-by-project evaluations of vertical datums used for flood protection, shore protection, hurricane protection, and navigation. It summarizes the basic steps taken to perform a project evaluation and what items to record in each project report. These reports will be retained by each District for their records and for implementation of corrective actions. The reports will be submitted to a database via a web-based reporting tool. The web-based reporting tool will generate a summary report to be signed and submitted to the Chief of Engineering and Construction by each District Command. Instructions for using the web-based reporting tool for upward reporting of District compliance are contained in this Appendix.

D-2. Applicability

This guidance applies to all federally authorized and constructed flood control, hurricane protection, shore protection, and navigation projects assessed under the CEPD project.

D-3. Scope

The guidance in this section provides minimum guidelines for recording the findings of project evaluations and upward reporting. Project evaluations are to be utilized for reporting project compliance, guiding corrective action, and for periodic project reassessments. Initial corrective action includes transitioning non-compliant projects to the correct datum(s) which may involve programming funds and executing the acquisition of geodetic or tidal surveys. Non-compliant projects transitioned to proper datums need to be reviewed and evaluated for operational deficiencies in design or construction uncovered during the execution of the CEPD.

D-4. District Evaluation Team

District Datum Coordinators have been appointed by their Districts as lead vertical datum coordinators with the responsibility to oversee the review of each project and approve/certify the evaluation report. District Datum Coordinators are encouraged to establish a team of knowledgeable individuals familiar with District projects to accomplish the mandated Comprehensive Evaluation of Project Datums. The District Datum Coordinator may want to consider an H&H engineer familiar with river and overland hydraulic modeling, a coastal engineer and/or surveyor familiar with tidal datums, and a project manager familiar with O&M, ICW, CEFMS, P2, and programming funds for future work. The size of the team will vary by District depending on the number and variety of projects to be reviewed and the amount of funding made available for the evaluations.

D-5. Funding Project Evaluation

Districts are instructed to fund the CEPD of flood control and hurricane protection projects operated and maintained by non-federal sponsors within the Inspection of Completed Works (ICW) account. The review of Corps-maintained projects, including navigation projects, is to be funded from existing O&M accounts associated with those projects. Depending on the phase of the project and activities currently underway during the evaluation period, other project funds (Construction General, General Investigations, etc.) may be applicable but need to be coordinated through Project Management. It is not the responsibility of the District Datum Coordinator to secure funding for project reviews or implementation of corrective actions. The executive office will be making periodic status reports to the Chief of Engineering and Construction and has the responsibility to fund these efforts.

The District Datum Coordinator is responsible to provide Project Management with timely evaluation reports including budget cost estimates such that funds can be programmed for corrective action. The District Datum Coordinator needs to work closely with Project Management to develop realistic implementation schedules and facilitate any additional PDT project reviews for possible new design/construction.

D-6. Example District Implementation Plan

Some District leaders may look to the District Datum Coordinator to provide an implementation plan as well as periodic status updates. The following example draft may provide assistance with communicating the CEPD effort to appropriate District elements.

CEPD Implementation Plan **DRAFT** **Jacksonville District**

1. BACKGROUND

   This document addresses lessons learned from findings of the Interagency Performance Evaluation Task Force (IPET) on Hurricane Katrina (see IPET Volume II: Geodetic Vertical and Water Level Datums). Findings of errors of one to three feet in some of the elevations used in design, construction, maintenance, and evaluation of hurricane and flood control structures in New Orleans highlighted the need to ensure that flood control and navigation projects are referenced to the proper vertical datums to correctly compensate for subsidence/sea level rise. Furthermore USACE needs to be referenced to the same nationwide reference systems used by other Federal and local agencies responsible for flood forecasting, hurricane surge and inundation modeling, navigation, flood insurance rate maps, hurricane evacuation route planning, coastal boundary delineation, bathymetric mapping, and topographic mapping.

   On 4 December 2006, Lieutenant General Strock issued a directive with interim guidance for Districts to perform a Comprehensive Evaluation of Project Datums (CEPD). This implementation plan is consistent with the permanent guidance being developed under direction of USACE-HQ.

2. AUTHORITY

   A. Section 224 of WRDA 1992 (33 U.S.C. 562).

   B. Interim Guidance For A Preliminary Evaluation Of Vertical Datums On Flood Control, Shore Protection, Hurricane Protection, And Navigation Projects**,** 31 October 2006

   C. MSC Memorandum, Subject: Implementation of Findings from Interagency Performance Evaluation Task Force for Evaluating Vertical Datums and Subsidence/Sea Level Rise Impacts on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects, 4 December 2006.

D. Clinger-Cohen Act of 1996 as amended.

E. Florida Statutes, Chapter 62B-33 Division of Beaches and Shores – Rules for Coastal Construction and Excavation - Subsection 62B-33.0081 Survey Requirements - All vertical datum specified on the survey and referenced to the NAVD of 1988 in feet.

F. Engineering Regulation (ER) 1110-1-8156

G. Engineering Manual (EM) 1110-1-2909

H. CECW-CE Memorandum for Major Subordinate Commanders, 2 July 2004, Subject: Watershed Management and the Implementation of Enterprise Geographic Information Systems (eGIS) in the USACE 2012 Environment.

I. CECW-CE Comprehensive Evaluation of Project Datums, DRAFT 05 February 2007. Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects.

3. RECOMMENDATIONS

A. Follow the lead of the Hurricane Katrina IPET Study (IPET 2006) in regards to the findings and lessons learned documented in Volume II: Geodetic Vertical and Water Level Datums.

B. For all future data collections, effective immediately, the following shall apply:

1. All new data (Hydrographic, Topographic, Cadastral, LIDAR, Remote Sensed Data, and other) collected in Florida and Georgia for civil works projects shall be in NAD 1983, NAVD 1988, and the applicable tidal datum as established by the Department of Commerce (MLLW 1983-2001 for navigation).

2. All new data (Hydrographic, Topographic, Cadastral, LIDAR, Remote Sensed Data, and other) collected in Puerto Rico and the USVI for civil works projects shall be in NAD 1983, PRVD 2002 where available, and/or the applicable tidal datum as established by the Department of Commerce (MLLW 1983-2001 for navigation).

3. Control sheets, channel limits, design templates, and other drawings shall be converted to the new datums. The official control drawings shall reside in the Project Wise System. For navigation projects the official datum is Mean Lower Low Water (MLLW 1983-2001) per WRDA 1992. As navigation projects and other project conditions surveys are conducted the control for the tide staffs must be surveyed to establish the NAVD 88 datum. The horizontal coordinates (NAD 83) can be derived from the NAD 1927 coordinates.

4. Notify all our sponsors by official letter from the District Engineer.

C. Transition to current vertical datums for collection, modeling, and reporting of inland surface and ground water stages.

1. All new regulation schedules issued with stage elevations labeled using NAVD88 as well as superseded datum values in Florida.

2. Gauges recalibrated to NAVD88 and stages reported in NAVD88 in Florida.

3. Convert gauge POR to NAVD88 or institute another convention to allow old data to be used for flood frequency studies.

4. In conjunction with SFWMD, convert water management operations to NAVD88 in Florida.

5. Convert hydraulic and hydrologic models to be “datum neutral”.

D. Enlist CCO in an outreach and public information campaign to educate stakeholders and the public on what we are doing, why we are doing it, and how it will affect them.

E. All technical elements at SAJ adhere to the published and required standards.

4. IMPLEMENTATION ACTIONS

An assessment is needed of the accuracy of flood/hurricane protection elevations on existing flood control, reservoir, impoundment, or like projects. Authorized coastal navigation projects need to be evaluated to ensure that maintained or constructed depths are based on the latest hydrodynamic tidal model. In addition, it is necessary to ensure all geospatial surveying and mapping is performed on datums that are consistent with national and Federal standards. During this review, special attention must be made to assess the following critical issues associated with a project's vertical reference:

- Controlling flood control structure elevations were designed relative to hydraulic or hydrodynamic models/studies that were based on reliable water-level gage data.
- Hurricane protection structure elevations have been designed and/or periodically corrected to the latest tidal epoch, and that these corrections additionally reflect any sea level, settlement, or subsidence/uplift changes.
- Permanent benchmarks for river, pool, reservoir, and tidal reference gages are placed at an adequate density and are accurately connected to the Department of Commerce National Spatial Reference Network (NSRS) used by Federal and local interests.
- Coastal navigation project depths are defined relative to Mean Lower Low Water (MLLW) datum and are being maintained to the latest tidal epoch (currently 1983-2001), as defined by the Department of Commerce and required by Section 224 of WRDA 1992 (33 U.S.C. 562), and that project depths are designed and maintained relative to hydrodynamic tidal models that are based on up-to-date water-level gage data.

5. IMPLEMENTATION SCHEDULE

SAJ will migrate to the new datums in an organized fashion based on a realistic schedule, in accordance with current guidance, and within funding constraints. In general, the following priorities will be adhered to for project evaluation and implementation of corrective action. However, projects with schedules and funding that lend themselves to immediate execution of CEPD guidance will be addressed as they become recognized.

1) Kings Bay and Herbert Hoover Dike

    1. Kings Bay is a critical naval facility with high tidal variances and known deficiencies in the project datum and project control.
    2. Herbert Hoover Dike is a vital structure protecting a significant population and economic region with known deficiencies in the project datum and project control. This evaluation effort will include HHD, the Okeechobee Waterway, and address the LORSS schedule.

2) Remaining Deep Draft Navigation Projects

    1. Corrective action for these projects can likely be provided by current O&M funds and are a high priority for USACE-HQ.

3) Remaining CERP Projects

    1. Prioritization of these projects will depend on available funds and some form of risk assessment (protected populations, known problems, subsidence, etc.).

4) Puerto Rico

    1. NGS is establishing a comprehensive vertical datum in Puerto Rico. Corrective action cannot be fully implemented until PRVD02 is completed. Implementation of Interim corrective action will depend on available funds and some form of risk assessment (protected populations, known problems, subsidence, etc.).

5) Beaches, Shallow Draft, USVI, etc.

    1. These projects are less critical (population, commercial risk, etc.) and will be addressed as scheduling and funding permits.

In some cases project datums will be corrected in an iterative process. Where practices are so outdated that even rudimentary corrections improve upon current conditions, short term corrections will be implemented immediately. These projects will still undergo evaluation with more permanent corrective action defined. For

example, the following actions can be taken to improve compliance with some deep draft projects that are not dependent on a full project review:

- Use of NOAA tide stations (MLLW 1983-2001) in lieu of historic USACE benchmarks where available
- Use of RTK tide corrections and the latest geoid model (currently geoid03) where applicable

6. STATUS OF CEPD GUIDANCE IMPLEMENTATION

Interim guidance was issued 04 December 2006 directing each District to appoint a District Datum Coordinator for training to be held in the spring of 2007 where permanent guidance will be presented. SAJ has appointed a District Datum Coordinator and established an SAJ CEPD team to keep abreast of guidance development and begin implementing the directive for project evaluations and corrective action.

In general, our navigation projects are non-compliant. Most, if not all, are referenced to MLW with an outdated tidal epoch. Project Management has requested additional program funds for navigation projects in order to facilitate compliance. Special attention is being paid to Fernandina Harbor (Kings Bay Naval Submarine Base). With direct contact with NOAA NOS (CO-OPS, NGS, OCS), USACE-HQ, and ERDC-TEC, SAJ is already taking steps to improve this project and bring it fully into compliance with the USACE-HQ directive. Once corrective actions are explicitly defined, the District Datum Coordinator will work closely with CO-OH to make similar corrections at all SAJ navigation projects (deep draft followed by shallow draft).

The CERP Geodetic Control Network established in south Florida for the Everglades restoration program exceeds the minimum accuracy requirements for creating NSRS connections to our projects. However, the accuracy requirements for CERP were defined by the hydraulic nature and sensitivity of the Everglades and further field effort is needed to firmly establish the relationship between all gauges (including Lake Okeechobee) and the control network. Coordination with USGS and SFWMD will take place to document what has, and what has not, been accomplished with plans formulated to complete this task. Operations Branch is putting together a plan to begin making these ties at all structures related to Lake Okeechobee and Herbert Hoover Dike.

Efforts are underway between the state of Florida and NOAA NGS to extend the CERP network north of Orlando, from the east coast to the west coast of Florida. A similar effort to our initial CERP Geodetic Control Network is underway between the Commonwealth of Puerto Rico and NOAA NGS to establish a comprehensive vertical datum (PRVD02) in Puerto Rico. We are cooperating closely with NGS during this effort to ensure that as many of our historic control benchmarks, and projects, as practical are tied directly to the new datum. LIDAR and imagery acquisition in Puerto Rico, underway for a few years, is collected and archived in such a manner that once PRVD02 is firmly established, the data can readily be converted.

Intermittent projects, due to project engineers aware of the interim guidance, are being updated during design. These actions will be formally documented once permanent CEPD guidance is distributed and the official project evaluation effort is underway.

D-7. Documentation of Project Evaluation

A standardized report format should be used for all project assessments. A project report submitted in a consistent format provides essential background information to the project engineers. The following outline may be used for guidance in preparing an assessment report for project datums. This outline is not definitive; any additional information deemed pertinent by the District Datum Coordinator is to be included in the project evaluation report.

Section D-8 provides details for on-line reporting requirements. The questions listed therein should be taken into consideration when preparing each project report. However, the report format is purposely free-form to allow for unique and differing project circumstances.

Outline for Project Evaluation Report Submittals

Section 1: General Project Information
Overview of the project including P2 project ID, project name, Digital Project Notebook project ID, active status, primary purpose of the project (flood protection, hurricane protection, shore protection, deep or shallow draft navigation), and whether or not the project is tidally influenced.

Section 2: Identify Data Sources
List out all sources of data used in the development of this report including the Digital Project Notebook, a local CADD database, map files, Detailed Design Memorandum, General Design Memorandum, Feasibility Report, local control database, NSRS, NWLON, ADCIRC tidal database, Plans and Specifications, the Engineering Technical Lead, H&H Project Engineer, and the current Project Manager.

Section 3: Determine Hydrological and Hydraulic Accuracy Requirements
Coordinate with the H&H Project Engineer to understand the hydraulic engineering applications and define the governing accuracy for connecting primary project control monuments to the regional NSRS. This section should provide a brief synopsis of project requirements.

Section 4: Review Project documents
Verify that the original and/or periodic maintenance design documents (DDM, GDM, P&S, etc.) indicate that constructed project elevations (or excavated navigation depths) are based on direct hydraulic or tidal observations, or that the relationship between the hydraulic datum and the geodetic datum used for construction was firmly established. Confirm that current project documents (or equivalent CADD databases) used in design or construction plans accurately describe the source and datum of any elevations or depths. Verify master project drawings, contract plans, and specifications have sufficient feature codes or metadata that notes the reference datum, source, location, adjustment epoch, and dates of tidal or hydraulic observations, monument descriptions, etc.

Confirm that all USACE operated and maintained projects have, at minimum, three up-to-date vertical control benchmarks identified in the contract plans and specifications from which to stake out construction. Confirm these controlling benchmarks have dual elevations on the latest adjustments and/or epochs: (1) hydraulic/tidal and (2) NAVD88 (NSRS).

Verify that contract documents require RTK vertical control for dynamic tidal projects.

Section 5: Evaluate Water Level Gauge Network
List all gauges with corresponding project datums as identified in historic project documents and files. Where applicable, provide the VM for each gauge tied to NWLON and the PID for each gauge benchmark tied to NSRS.

Verify the existence of a permanent water level gauge network that adequately defines the spatially varying hydraulic or tidal datum in the project region. Existing or historic gauges should be established at a sufficient density such that the spatially varying hydraulic datum anomalies are (or were) modeled to an accuracy consistent with project requirements.

Confirm that one benchmark at each gauge site (or at a control structure site or levee segment) is geodetically (orthometrically) connected to the currently recognized national vertical datum (NAVD88) on the National Spatial Reference Network maintained by the National Geodetic Survey (NGS). Verify the measure down at the gauge is clearly established/defined/etc. to the water surface and noted on the appropriate datasheet in the NSRS.

Make sure that coastal navigation projects were converted from Mean Low Water (MLW), Mean Low Gulf (MLG), or other local tidal datums, to MLLW as a result of the requirements in WRDA 92 (33 U.S.C 562) that superseded older tidal datums and epochs; and that these revisions are based on the latest tidal model and not on approximated or estimated translations (e.g., VERTCON). Verify that water level datums for rivers and non-tidal channels are based on the mean depth for a continuous period of fifteen days of the lowest water in the navigation season of any year and the year of adjustment is reflected in the datum name.

Verify hydraulic-based inland river reference datums (and reference benchmarks therefore) are firmly connected to river gauges and the NSRS.

Section 6: Evaluate Project Control
List all project control and project datums as identified in historic project documents and files. Where applicable, provide the PID for each benchmark tied to NSRS. Confirm these controlling benchmarks have dual elevations on the latest adjustments and/or epochs: (1) hydraulic/tidal and (2) NAVD88 (NSRS) and the horizontal datum is NAD83.

In areas where subsidence or crustal uplift is known to exist, this connection must have been made periodically in order to monitor potential loss of flood protection or navigation grade. Verify that reported elevations of coastal protection structures and maintained depths of navigation projects fully account for geological and climatological factors that may impact their integrity.

Verify permanent benchmarks on navigation projects are at a sufficient density (i.e., spacing) needed to adequately model the water surface for project maintenance, including controlling dredging grades and related measurement and payment/clearance surveys. For tidal navigation projects, consider the need for RTK vertical control (especially for dynamic offshore or non-protected waters).

Section 7: Review Periodic Gauge Inspection Program
Make sure USACE operated gauge networks are periodically inspected at adequate intervals to verify the gauge reference setting and confirm that the measure down is clearly established/defined/etc. to the water surface. Verify USACE operated water level gauges are referenced to, at minimum, three (3) permanent benchmarks, as defined in EM 1110-2-1002 (*Survey Markers and Monumentation*). Verify that each scheduled inspection visit connects the gauge reference mark to stable benchmarks by 3rd Order differential levels—see EM 1110-1-1005 (*Control and Topographic Surveying)*.

Section 8: Define Corrective Action
For projects requiring corrective actions, identify specific steps required to implement the corrective actions. Include a brief narrative where necessary to provide clear guidance on future efforts.

Section 9: Cost Estimate
Develop a budget cost estimate, showing effort and rates, to implement the corrective action(s). Provide enough information to facilitate a future, more thorough, independent government estimate if necessary.

Section 10: Implementation Plan
At a minimum, identify the funding source and estimated date for completion for corrective actions. Where applicable, include milestones addressing contract administration and/or begin and end dates for individual steps identified above.

Section 11: Potential One-Time Cost-Avoidance Savings (Navigation Projects)
Coastal navigation projects should include an estimate of potential one-time savings for dredge construction or maintenance as a result of bringing the project datum into compliance with WRDA 92.

Districts should maintain a file (digital or hard copy) for each project that contains the project evaluation report and copies of important information used in developing the report including data from on-line resources (NGS datasheets, CO-OPS benchmark sheets, etc.), copies of control sheets from construction documents, and copies of relevant pages from Design Memorandums and General Design Memorandums. The reports should be detailed but do not need to be exhaustive. These reports can function as an executive summary for a more comprehensive file maintained by the District. All file information should be organized and clearly dated to facilitate periodic project reassessments, reducing the cost of future reviews.

D-8. Reporting Findings from Project Evaluations

Completed project evaluation reports are to be converted to Adobe Acrobat PDF file format for submission and distribution. All reports will be submitted via a web-based reporting tool for compliance tracking in addition to being submitted to the current Project Manager. The Project

Manager has the responsibility to distribute the report to the Project Delivery Team (PDT), including the Engineering Technical Lead and H&H Technical Lead.

The primary focus of this document is to evaluate and report compliance with appropriate use of vertical datums in design and construction. Additional guidance may be developed to instruct Districts with regard to evaluating the findings of the CEPD as they impact design, construction, and operation of federally authorized flood protection, shore protection, hurricane protection, and navigation projects and tracking corrective actions to implement appropriate project changes through new design and construction including public notices where project changes are significant. The District Datum Coordinator is responsible for the evaluation of project datums, defining corrective action for non-compliant projects in order to transition the project to the proper datum(s), reporting of all findings to the District Commander and appropriate PDT members, and submitting required information via the web-based reporting tool. Project PDT members will be responsible for implementing corrective action to bring a project into compliance and defining any necessary actions with regard to new design and construction work.

Upon completing the evaluation of each project, the District Datum Coordinator is to access the web-based reporting tool, provide basic information regarding the project, and submit the project evaluation report. When all project evaluations have been completed for the District, it will be possible to generate a summary report for the District Commander's signature and subsequent submission to the Chief of Engineering and Construction. District Datum Coordinator's should be prepared to brief their District Commander and Project Managers with regard to the status of implementing corrective action. The Chief of Engineering and Construction may require periodic updates to the web-based reporting tool and subsequent updated summary reports with the District Commander's signature.

The following questions are to be answered utilizing the web-based reporting tool:

1. **General Project Information**
    a. P2 project ID?
    b. Project name?
    c. Digital Project Notebook project ID?
    d. Is the project, or a portion thereof, currently authorized? (*yes/no*)
    e. What is the primary purpose of the project (*pick one*)?
        i. Flood protection
        ii. Hurricane protection
        iii. Shore protection
        iv. Navigation
            1. Tidal v. Non-Tidal (*pick one*)
            2. Deep Draft v. Shallow Draft (*pick one*)

2. Identify Data Sources

a. Digital Project Notebook? (*yes/no*)

b. Local CADD/GIS database? (*yes/no*)

c. Historic map files? (*yes/no*)

d. Detailed Design Memorandum? (*yes/no*)

e. General Design Memorandum? (*yes/no*)

f. Plans and Specifications? (*yes/no*)

g. Current Engineering Technical Lead for the project? (*yes/no*)

i. Does attached evaluation report list the name of the current ETL? (*yes/no*)

h. Current H&H Project Engineer for the project? (*yes/no*)

i. Does attached evaluation report list the name of the current H&H Project Engineer? (*yes/no*)

i. Current Project Manager? (*yes/no*)

i. Does attached evaluation report list the name of the current Project Manager? (*yes/no*)

3. Determine Hydrological and Hydraulic Accuracy Requirements

a. Did the H&H Project Engineer define the governing accuracy for connecting primary project control monuments to the regional NSRS? (*yes/no*)

1. If yes, provide value

2. If no, provide value to be used based on professional judgment

a. Does the attached evaluation report include a brief explanation detailing the basis for this value? (*yes/no*)

4. Review Project Documents

a. Does project have a minimum of three up-to-date vertical control benchmarks identified in the latest version of the contract plans and specifications from which to stake out construction? (*yes/no*)

b. Do the original and/or periodic maintenance design documents (DM, GDM, P&S, etc.) indicate that constructed project elevations (or excavated navigation depths) are based on direct hydraulic or tidal observations, or that the relationship between the hydraulic datum and the geodetic datum used for construction (e.g., NGVD 29 or NAVD 88) was firmly established? (*yes/no*)

i. If yes, provide supporting documentation (*pdf copy of construction plans*)

c. (*tidal*) Do project conditions (large variance in tidal mean range across project; dynamic offshore or non-protected waters) require the use of RTK for vertical control? (*yes/no*)

i. If yes:

1. Do the contract documents require RTK vertical control? (*yes/no*)

2. Does the attached evaluation report include a brief explanation detailing the basis for the tidal-geoid correction? (*yes/no*)

5. Evaluate Water Level Gauge Network

a. Does a permanent water level gauge network (existing or historic gauges) adequately define the spatially varying hydraulic or tidal datum in the project region to an accuracy consistent with project requirements? (*yes/no*)

b. Is the measure down at the gauge clearly established/defined/etc. to the water? (*yes/no*)

i. If yes, is this information clearly stated in the recovery notes of the controlling NSRS benchmark? (*yes/no*)

1. If yes, provide PIDs of primary benchmarks

c. (*tidal*) Project referenced to MLLW in the current tidal epoch? (*yes/no*)

i. If yes, provide NOAA CO-OPS Tide Station IDs

d. (*non-tidal*) Is the project's hydraulic-based inland river, non-tidal channel, or pool reference datum (and reference benchmarks) firmly connected to water level gauges and the NSRS? (*yes/no*)

i. If yes:

1. provide PIDs of primary benchmarks

2. Does the attached evaluation report include a brief explanation detailing the basis for the hydraulic datum (how was it established)? (*yes/no*)

6. Evaluate Project Control

a. Do the controlling benchmarks have dual elevations on the latest adjustments and/or epochs: (1) hydraulic/tidal and (2) NAVD88 (NSRS)? (*yes/no*)

i. If yes, provide PIDs of primary benchmarks

b. Are the controlling benchmarks referenced to NAD83? (*yes/no*)

c. Does the project footprint reside in an area where subsidence or crustal uplift is known to exist? (*yes/no*)

i. If yes, is the NSRS connection periodically updated in order to monitor potential loss of flood protection or navigation grade? (*yes/no*)

d. (*navigation - tidal/non-tidal*) Are permanent benchmarks at a sufficient density (i.e., spacing) needed to adequately model the water surface for project maintenance, including control of dredging grades and related measurement and payment/clearance surveys? (*yes/no*)

7. Review Periodic Gauge Inspection Program

a. Is the project gauge network operated by USACE? (*yes/no*)

i. If yes:

1. Are the gauges periodically inspected at adequate intervals to verify the gauge reference setting and confirm that the measure down is clearly established/defined/etc. to the water surface? (*yes/no*)

2. Are the water level gauges referenced to a minimum of three (3) permanent benchmarks, as defined in EM 1110-2-1002 (*Survey Markers and Monumentation*)? (*yes/no*)

a. If yes, provide PIDs of primary benchmarks

3. Are 3rd Order differential level connections performed from the gauge to the reference marks during scheduled inspection visits (see EM 1110-1-1005 Control and Topographic Surveying)? (*yes/no*)

8. **Define Corrective Action**
   a. Project Compliant (*yes/no*)
      i. If no,
         1. What is the estimated cost for compliance?
         2. What is the estimated completion date?
         3. (*tidal*) What is the estimated cost-avoidance?
         4. What is the estimated cost of assessment?
9. **Submit report** (Adobe PDF file)

D-9. Example Project Evaluation Report: Non-compliant Deep Draft Navigation

The following example report is provided in order to illustrate the level of effort and detail needed for reporting a project assessment. This example report is a simulation and contains some fabricated data.

******simulated report for illustrative purposes only- this project has not been evaluated******

CEPD Evaluation Report: Kings Bay P2 Project ID 945804753904

Section 1: General Project Information

DPN:3064
Status: Authorized
Type: Navigation, deep draft (tidal)

Section 2: Data Sources

DPN
ProjectWise CADD files
Contract W912EP-06-C-0124 (P&S)
ETL: Jane Smith
H&H:Jane Smith
PM: John Smith
District BENCH control database
NSRS/NWLON on-line databases
Memorandum Report: Tidal Relations along the Saint Mary's Entrance Channel to Kings Bay, Fernandina, Florida (Brian Shannon, 1998)

Section 3: Hydrological and Hydraulic Accuracy Requirements

This is a deep draft navigation project for the U.S. Navy. NSRS publication of control is not pivotal but is useful. In accordance with CEPD guidance, use of NWLON control to establish a consistent MLLW 1983-2001 reference datum throughout the project area to an accuracy of +/- 0.25 ft. is an essential requirement.

Section 4: Project Documents

Current project documents will need to be updated to accurately describe the source and datum of all elevations and depths relative to MLLW 1983-2001. Tide stations, benchmarks, and PIDs of all project control needs to be tabulated on contract documents with NAVD88 to MLLW 1983-2001 clearly defined. The location of all control should be clearly shown in the contract plans. Contract documents currently require RTK vertical control for a portion of the project but not all.

Section 5: Water Level Gauge Network

A sufficiently dense network of current and historic NOAA tide gauges and benchmarks exists throughout the project area to facilitate an accurate model of MLLW 1983-2001. Use of RTK with an accurately defined MLLW 1983-2001

tidal datum for vertical control is required for all P&S and measurement and payment surveys conducted for this project.

Tide Stations with available data on-line
Tide Station 8679511 Kings Bay, GA
Tide Station 8679758 Dungeness, Seacamp Dock, GA
Tide Station 8679945 Beach Creek, GA
Tide Station 8720030 Fernandina Beach, Amelia River, FL – Only station with an established tie to the NSRS (PIDs: BC0160, BC0166, BC0167, BC0171, BC0174, BC0175, BC1542, BC1543, BC1815, BC2522)

Historic Tide Stations shown on-line but data must be requested (CO-OPS)
Tide Station 8679909 Range "A" Light Tower
Tide Station 8720011 Cut 1n Front Range, St. Marys River Entr
Tide Station 8720008 Platform Off Tiger Island
Tide Station 8720012 Cut 2n Front Range, St. Marys River Entr

Historic Tide Stations shown only in CO-OPS Station Index – data must be requested (CO-OPS)
Tide Station 8679411 South Cumberland Is. Outside
Tide Station 8679598 Cumberland Snd. Daymarker 22
Tide Station 8679964 St. Marys, St. Marys River
Tide Station 8679997 St Marys Jetty
Tide Station 8679998 St. Mary's Ent. Chl., Offshore Platform
Tide Station 8720001 St. Marys River Headwaters
Tide Station 8720002 St. Marys River, Seaboard Coast Rr
Tide Station 8720003 Crandall, St. Marys River
Tide Station 8720004 Crandall, St. Marys River
Tide Station 8720005 Fort Clinch, Amelia Island
Tide Station 8720006 Little St. Marys River
Tide Station 8720007 Roses Bluff
Tide Station 8720009 Amelia River Ent.
Tide Station 8720023 Chester, Bells River
Tide Station 8720028 Bells River Ent.
Tide Station 8720031 Fernandina Beach, (Backup)
Tide Station 8720036 Fernandina, Terminal Corp Dock

Project datum has not been updated in accordance with WRDA 92. The entire project needs to be updated to MLLW 1983-2001.

- Project datum for southern portion is MLLW 1960-1978
- Project datum for northern portion is undocumented but believed to be MLW (epoch unknown)

Section 6: Project Control

GPS reference station at Fort Clinch (MLLW 1960-1978; reportedly established from NOAA tide station 8720030 Fernandina Beach, Amelia River). Project referenced to NAD83 (PIDs above).

Surveys for PCS, P&S, and measurement & payment are conducted utilizing RTK tide corrections based on MLLW 1960-1978 established for GPS reference station at Fort Clinch for the southern portion of the project (Cut A through Cut G).

Surveys for the northern portion of the project, Dungeness Seacamp Dock to Kings Bay, are controlled by tide staffs of unknown origin. It is assumed that these staffs were established from NOAA benchmarks and set to MLW but are one or two epochs out of date.

Only one tide station for the project has published NSRS connections. However, all the tide stations have published NWLON connections. The project currently does not account for sea level rise and is being maintained to a depth beyond current authorization. Defining and using a MLLW 1983-2001 datum based on the NWLON tide stations in the area will bring this project into compliance. Connecting more of the tide stations (benchmarks) to the NSRS via OPUS-DB is recommended in order to facilitate V-Datum development and establish a clear relation between NAVD88 and MLLW 1983-2001 for the area but isn't absolutely necessary since all project work is authorized relative to MLLW 1983-2001.

Once MLLW 1983-2001 is properly established for the project area, a sufficient number of vertical control benchmarks should exist to satisfy this requirement. Recommend field verification of bench marks still in existence with recovery notes submitted to NGS/CO-OPS.

Section 7: Periodic Gauge Inspection Program

NA – gauges owned and operated by NOAA. Third order levels should be run between benchmarks during each survey and tide staff established/checked. Tide correction results should be compared to on-line NOAA results.

Section 8: Corrective Action

SUMMARY OF CORRECTIVE ACTIONS

1. establish MLLW 1983-2001 for project area
   a. request unavailable tidal data from CO-OPS
   b. model MLLW 1983-2001 using a spatial interpolation tool
2. field work
   a. establish NSRS ties to tide stations 8679511, 8679758, 8679945, and 8720030 using GPS and OPUS-DB (Optional: facilitates V-Datum development and establishes MLLW 1983-2001 to NAVD88 separation for KTD file)
   b. run third order levels to secondary tidal BMs and submit via OPUS-Levels
   c. set tide staffs to facilitate field verification of tidal corrections during surveys
   d. set any required RTK base benchmarks at secure or permanent sites
3. establish HYPACK KTD file for surveys
4. update current design and contract documents with new project control including all benchmark metadata

Section 9: Cost Estimate

Contract Administration

USACE hired-labor, technical S&A	5 MD @ $800/MD	$4000
USACE hired-labor, CT admin charges	5 MD @ $800/MD	$4000
USACE hired-labor, travel (recon)	$1000	$1000
		$9,000

A-E Contract Line Items

Mob/demob to project site	2 CD @ $2500/CD	$5000
Static GPS & 3rd order levels	2 CD @ $2500/CD	$5000
Set tide staffs (on-shore)	2 CD @ $2500/CD	$5000
Set tide staff at front range	1 CD @ $2500/CD	$2500
Set secure RTK base benchmark	1 CD @ $2500/CD	$2500
Field verify tidal datum model/KTD (performed at later date)	1 CD @ $2500/CD	$2500
		$22,500

Data Processing and Reporting

Model MLLW 1983-2001	10 MD @ $800/MD	$8000
Develop HYPACK KTD file	1 MD @ $800/MD	$800
QA A-E field work/OPUS submissions	5 MD @ $800/MD	$4000
Update design/contract documents	2 MD @ $800/MD	$1600
		$14,400

Summary of Budget Cost Estimate

Contract Administration		$9,000
A-E Contract Line Items		$22,500
Data Processing and Reporting		$14,400
	Subtotal	$45,900
Contingencies @ 20%		$9,180
	Total Budget Estimate	$55,080

Section 10: Implementation Plan

PM: John Smith
FWI: L0BB0 A-E SVCS $22,500 available 01 June 2007
Labor: 072D14 $23,400 available 01 June 2007

01-30 June 2007
- request historic tidal data from NOAA/CO-OPS
- task order contract administration including SOW, government estimate, RFP, pre-negotiation memorandum, negotiation memorandum, and NTP
- begin modeling tidal datum

01-31 July 2007
- execute task order

01-31 August 2007
- finish tidal model
- QA A-E field work
- process and submit data to OPUS-DB and OPUS-Levels
- update design and construction documents
- develop and field verify KTD file

Section 11: Potential One-Time Savings

Estimated volume = 18 miles (95040 ft.) long x 500 ft. wide x 0.25 ft. sea level rise ÷ 27 cf/cy = 440,000 cy
Estimated cost reduction = 440,000 cy x $10/cy = $4,400,000

D-10. Example Project Evaluation Report: Compliant Deep Draft Navigation

The following example report is provided in order to illustrate the level of effort and detail needed for reporting a project assessment. This example report is a simulation and contains some fabricated data.

******simulated report for illustrative purposes only – this project has not been evaluated******

CEPD Evaluation Report: Key West Harbor P2 Project ID 386262040802

Section 1: General Project Information

DPN:4867
Status: Authorized
Type: Navigation, deep draft (tidal)

Section 2: Data Sources

DPN
ProjectWise CADD files
Contract W912EP-05-C-0254 (P&S)
ETL: Jayne Sumner
H&H:Jayne Sumner
PM: Jon Smyth
District BENCH control database
NSRS/NWLON on-line databases
ADCIRC Tidal Database
Complexities of Tidal Zoning for Key West, FL (Kristen A. Tronvig and Stephen K. Gill, THSOA 2001)

Section 3: Hydrological and Hydraulic Accuracy Requirements

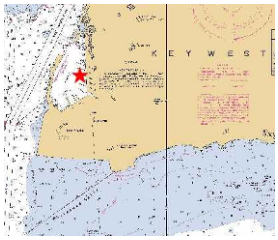
This is a deep draft navigation project for the U.S. Navy. NSRS/NWLON control meets project requirements and CEPD guidance.

Section 4: Project Documents

See Contract W912EP-05-C-0254, P&S. Contract documents clearly define Tide Station 8724580 and all benchmarks as project control. Survey notes indicate control marks and datum used to generate all data. Tidal observations are maintained by NOAA and available on-line, no additional metadata necessary. Project documents clearly require use of RTK and latest geoid model (currently Geoid03).

Seven benchmarks listed in the contract plans have NAVD88 and MLLW 1983-2001 elevations. Project documents plainly indicate MLLW 1983-2001 (see Contract W912EP-05-C-0254, P&S). The relationship between NAVD88 and MLLW 1983-2001 is clearly defined both graphically and in text.

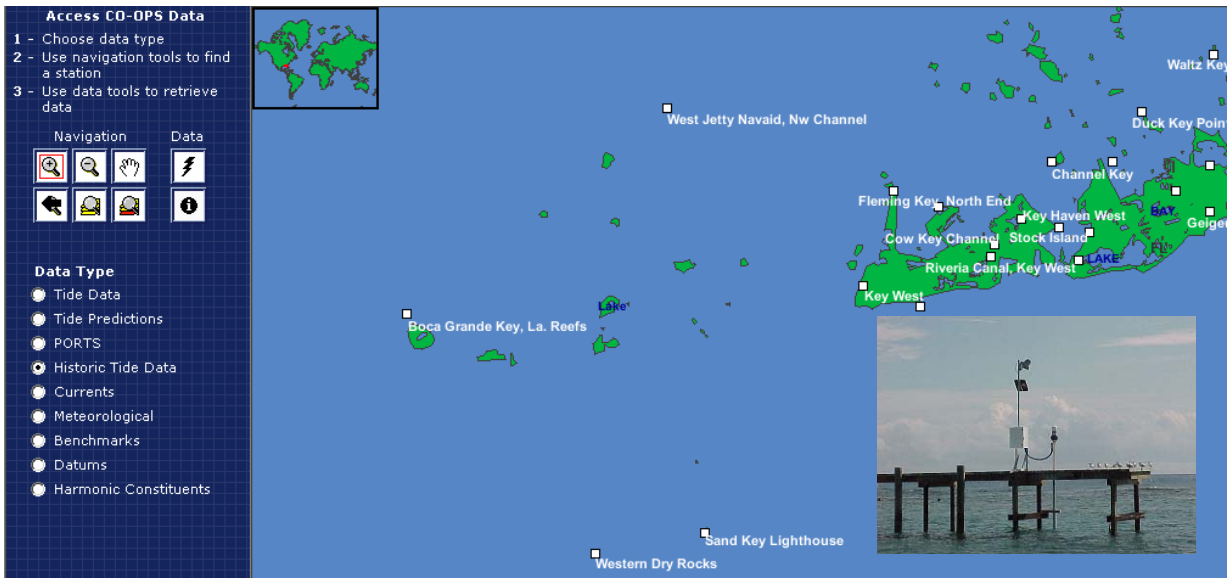
Section 5: Water level gauge network



Project control was established from NOAA Tide Station 8724580 in Truman Basin, Key West Florida.

NWLON VM#: 13915, 706, 710, 712, 714, 716, 1781, 12415, 13696, 15837

NSRS PID: AA0009, AA0003, AA0005, AA0007, AA0008, AA1753, AA1645



Further investigations reveal that mean tide range of Sand Key Lighthouse (Tide Station 8724635) is within 0.05-ft. of tide station in Truman Basin. ADCIRC Tidal Database also confirms uniform offshore tide range in project area.

Project datum has been updated to MLLW 1983-2001 in accordance with WRDA 92. Tide Station 8724580 benchmarks are published in the NSRS. Project is on the current tidal datum epoch and therefore maintained depths fully account for sea level rise.

Section 6: Project Control

Hydrographic surveys performed with RTK (Geoid03) base station set on one of the control marks listed above. Third order levels are performed between marks prior to surveying. RTK tide corrections are calibrated to NOAA tide staff

on site. Station recovery notes are submitted to NSRS and levels are submitted to OPUS-Levels. Project referenced to NAD83.

Project is controlled from one NOAA Tide Station in combination with RTK GPS and Geoid03 for tidal corrections. Conversations with Dr. Dan Roman [NOAA NGS] confirm that Geoid03 is applicable for this "near shore" (7 miles) project given the lack of tide station data available.

Section 7: Periodic Gauge Inspection

NA – gauges owned and operated by NOAA. Third order levels run between benchmarks during each survey and tide staff established/checked. Tide correction results compared to on-line NOAA results.

Section 8: Corrective Action

Project is compliant with CEPD guidance. No corrective action required at this time.

D-11. Example Project Evaluation Report: Non-compliant Shallow Draft Navigation

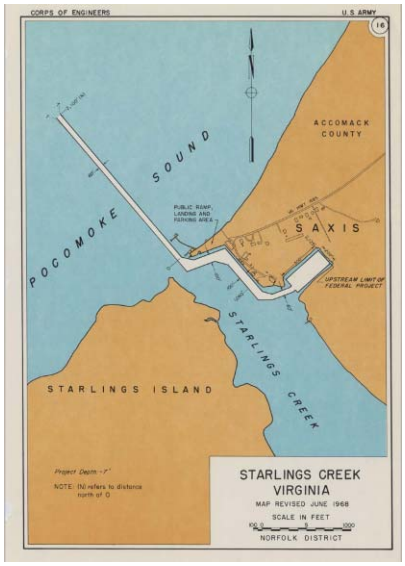
The following example report is provided in order to illustrate the level of effort and detail needed for reporting a project assessment. This example report is a simulation and contains some fabricated data.

******simulated report for illustrative purposes only – this project has not been evaluated******

CEPD Evaluation Report:	**Starlings Creek, Saxis Harbor, VA**	**P2 Project ID 386262040802**

Section 1: General Project Information

DPN:9865
Status: Active
Type: Navigation, shallow draft (tidal)



Section 2: Data Sources

DPN
ProjectWise CADD files
Map files
Feasibility Report
General Design Memorandum
Detailed Design Memorandum
ETL: Jackie Welp
H&H:Ted Hack
PM: Don Sneed
NWLON on-line database

Section 3: Hydrological and Hydraulic Accuracy Requirements

Aside from being on the wrong tidal epoch, this shallow draft navigation project is suitably controlled to meet project accuracy requirements and CEPD guidance.

Section 4: Project documents

Project documents need to be updated to latest tidal epoch.

Section 5: Water Level Gauge Network

Tidal datums at SAXIS, STARLING CREEK based on:

TIDE STATION:	8633777 SAXIS, STARLING CREEK, VIRGINIA
CONTROL TIDE STATION:	8632200 KIPTOPEKE, CHESAPEAKE BAY
LENGTH OF SERIES:	4 MONTHS
TIME PERIOD:	August 1988 - November 1988
TIDAL EPOCH:	1983-2001

VM#: 4869, 4867, 4868, 4870, 4871, 4872, 4873

PID: XX1234, ZZ1234

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

MEAN HIGHER HIGH WATER (MHHW)	= 0.774
MEAN HIGH WATER (MHW)	= 0.724
MEAN TIDE LEVEL (MTL)	= 0.383 (1.26 ft)
MEAN SEA LEVEL (MSL)	= 0.381 (1.25 FT)
MEAN LOW WATER (MLW)	= 0.042
MEAN LOWER LOW WATER (MLLW)	= 0.000

There is no need (or justification) to perform a tidal model for this small project. Sufficient information exists to interpolate and verify a suitable MLLW datum for the project footprint.

Section 6: Project Control

Current project control is based on a superseded tidal epoch and NAD83. Bench marks are published in the NWLON and the NSRS database. There are a sufficient number of tidal benchmarks to control measurement and payment surveys for maintenance dredging.

Section 7: Periodic Gauge Inspection Program

NA – gauges owned and operated by NOAA. Third order levels run between benchmarks during each survey and tide staff established/checked.

Section 8: Corrective Action

SUMMARY OF CORRECTIVE ACTIONS

1. update current design and contract documents with new project control including all benchmark metadata
2. update KTD file

Section 9: Cost Estimate

Update design/contract documents	2 MD @ $800/MD	$1600
Contingency	25%	$400
	Total Budget Estimate	$2000

Section 10: Implementation Plan

PM: Don Sneed
FWI: L0BB0 A-E SVCS $2,000 available 01 June 2007
Labor: 072D14 $2,000 available 01 June 2007

15-30 June 2007

- update design and construction documents
- develop KTD file (field verify during next project survey)

Section 11: Potential One-Time Cost-Avoidance Savings

Estimated volume = [(100 ft. x 1100 ft.) turning basin + (200 ft. x 500 ft.) harbor + (60 ft. x 2100 ft.) channel] x 0.33 ft. sea level rise ÷ 27 cf/cy = 12,500 cy

Estimated cost avoidance = 12,500 cy x $10/cy = $125,000

D-12. Example Project Evaluation Report: Flood Protection

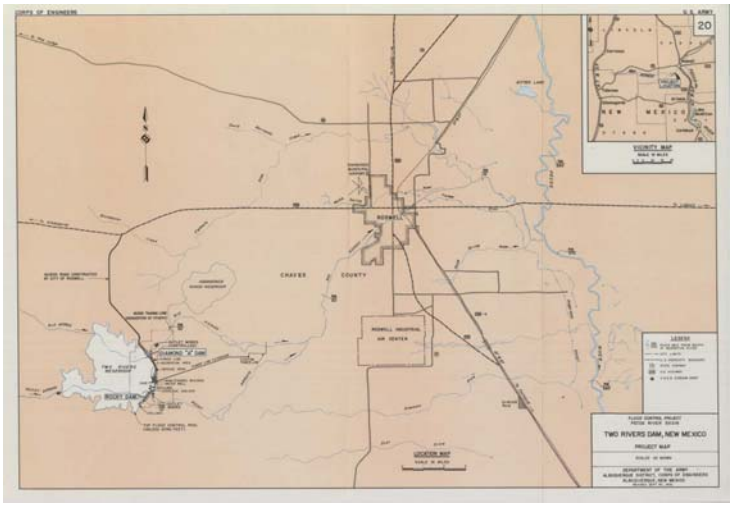
The following example report is provided in order to illustrate the level of effort and detail needed for reporting a project assessment. This example report is a simulation and contains some fabricated data.

******simulated report for illustrative purposes only – this project has not been evaluated******

CEPD Evaluation Report:	**Two Rivers Dam, NM**	**P2 Project ID 895092040802**

Section 1: General Project Information

DPN:8375
Status: Active
Type: Flood Protection



Section 2: Data Sources

DPN
ProjectWise CADD files
Map files
Feasibility Report
General Design Memorandum
Detailed Design Memorandum
ETL: John Rooster
H&H:Danielle Crassburn
PM: Theodore Muck

Section 3: Hydrological and Hydraulic Accuracy Requirements

H&H project requirements are met utilizing CEPD guidance for NSRS connections at accuracy of 0.25 ft. with internal project control accuracy at 0.1 ft.

Section 4: Project documents

Project documents adequately describe project control based on current status. However, these documents will have to be updated once the project is brought into compliance.

Section 5: Water Level Gauge Network

Rocky gauge (Corps bench marks “Clyde”, “A-76”, “AJF476”)
Diamond “A” gauge (Corps bench marks “97654”, “RM-1”, “RM-2”)
Rio Arroyo gauge (USGS bench marks “B789”, “A123”, “B867”)
Rio Hondo (USGS bench marks “Mill”, “Hondo”, “982”)

Water level gauges on site are not tied to national database. Two Rivers Reservoir datum is defined as a ”fixed offset of 3500 ft. from mean sea level” and needs to be tied/defined to NSRS (NAVD88). Spacing of gauges is sufficient to establish water level surface over project area.

Section 6: Project Control

Deformation monitoring marks are not currently tied into the NSRS ("Clyde", "A-76", "AJF476", "97654", "RM-1", "RM-2").

Project not currently tied to NSRS. A 10 mile radial search of the NGS database yields no vertical control within 5 miles of project site. Most marks set in the 1930s on Hwy 70 ROW. Marks out to BM E 203 have not been recovered since the 1930s and are probably no longer there. Given that the marks are greater than 60 years old, there is a high probability that an extensive static GPS vertical network will be required at this site.

A radial search of the NSRS for 1st Order vertical control out to 25 miles yielded a few potential points. These are typically 12 to 20+ miles scattered around Roswell, NM but have not been recently recovered. It is best to assume NSRS ties to be made via CORS/OPUS. Horizontal ties to NAD83 will be incidental to vertical ties.

Section 7: Periodic Gauge Inspection Program

Gauges are inspected annually within the ICWs program. Third order levels are run between bench marks and gauges. Gauges are visually inspected to verify they are functioning properly. Measure-down values are checked annually.

Section 8: Corrective Action

Tie in one primary benchmark at project site to NAVD88 / NAD83 using CORS-Only/OPUS solution. Add this primary mark to NSRS. Level to other project control (Corps and USGS) on project site including gauges and measure-down values. Update project documents accordingly.

Section 9: Cost Estimate

Contract Administration

USACE hired-labor, technical S&A	10 MD @ $800/MD	$8000
USACE hired-labor, CT admin charges		$7500
USACE hired-labor, travel (recon)	2 MD @ $800/MD	$1600
	Travel	$600
		$17,700

A-E Contract Line Items

Mob/demob to project site	2 CD @ $2500/CD	$5000
Recon for existing NSRS or Corps control	2 CD @ $2500/CD	$5000
Static GPS	1 CD @ $2500/CD	$2500
3rd order leveling	2 CD @ $2500/CD	$2500
		$15,000

Data Processing and Reporting

Reduce field notes and organize data for submission	2 MD @ $800/MD	$1600
Input data to NSRS & coordinate with NGS	1 MD @ $800/MD	$800
Update design/contract documents	2 MD @ $800/MD	$1600
		$4,000

Summary of Budget Cost Estimate

Contract Administration		$17,700
A-E Contract Line Items		$15,000
Data Processing and Reporting		$4,000
	Subtotal	$36,700
Contingencies @ 25%		$9,175
	Total Budget Estimate	$45,875

Section 10: Implementation Plan

PM: Theodore Muck
FWI: L0BC0 A-E SVCS $15,000 available 01 June 2007
Labor: 072D14 $21,700 available 01 June 2007

01-30 June 2007
- task order contract administration including SOW, government estimate, RFP, pre-negotiation memorandum, negotiation memorandum, and NTP

01-31 July 2007
- execute task order

01-31 August 2007
- QA A-E field work
- process and submit data to OPUS-DB
- update design and construction documents

Section 11: Potential One-Time Cost-Avoidance Savings

NA